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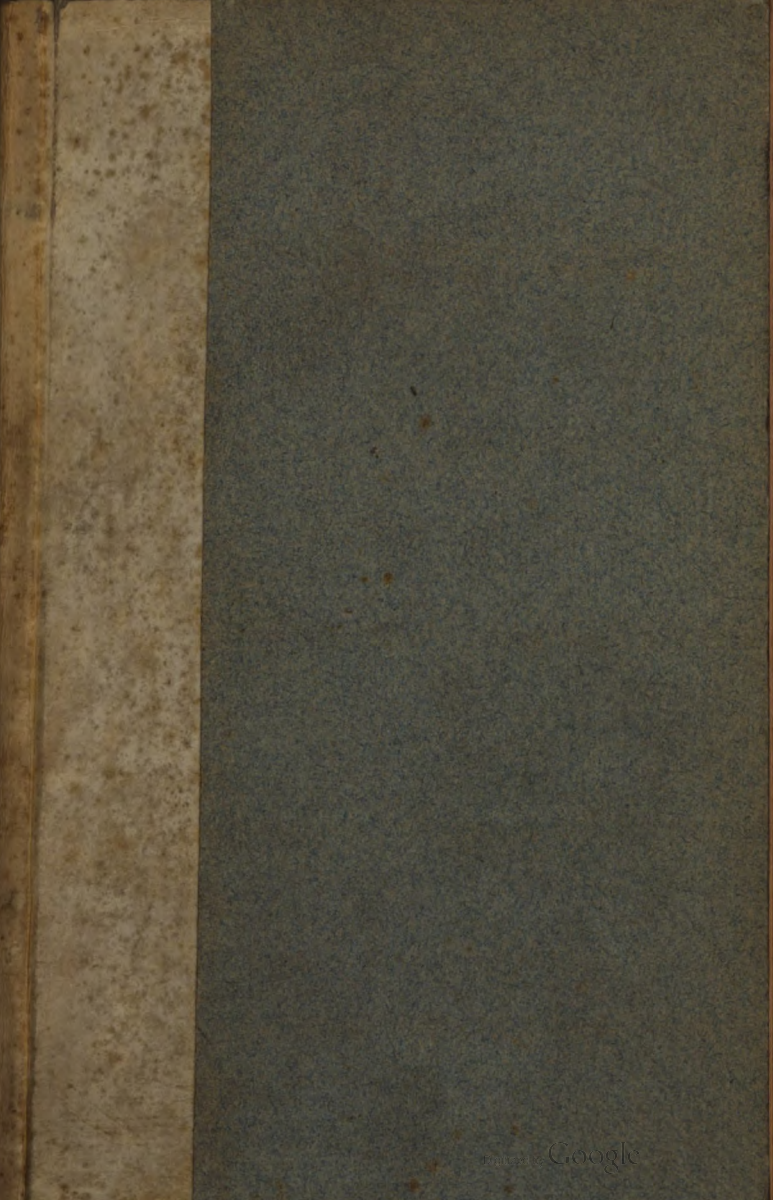
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THE
A B C
OF
MODERN PHOTOGRAPHY.

COMPRISING
PRACTICAL INSTRUCTIONS IN WORKING GELATINE
DRY PLATES.

BY W. K. BURTON, C.E.

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INTRODUCTION.

BEFORE entering on the actual lessons which we are about to give, we should like to explain our object in taking in hand the task.

After Archer brought out his collodion process, photography for the first time became a popular amusement with those who had a leaning to art or science, or both. The scientific interest and novelty attaching to the then comparatively new process, combined with a totally false idea of how easy it would be by means of it to make a "picture," attracted enormous numbers of those who had some spare time on their hands to take up the subject as amateurs. After a time many of these found that their expectations were scarcely fulfilled, and they found, too, to their surprise, that a mere transcript from nature was not necessarily a picture, but that as much art culture, if not as much skill, was required when the tools were the camera and lens, as when they were the pencil and brush. They found, also, that the skill required was greater than they had supposed—that at least a slight knowledge of

chemistry and of physics was necessary, or endless troubles would arise.

The realization of these facts greatly thinned the ranks of the amateurs. Another era has, however, now arisen in photography—the era of the dry gelatine process. The skill necessary to produce a photograph has been greatly reduced. The plate is now no longer prepared by bringing into contact, immediately before exposure, two fickle and uncertain chemicals—the “collodion” and the “bath”—but it may be purchased ready made, will keep, so far as we know, indefinitely, and may be exposed at any time. True, the artistic feeling is as necessary as ever; but that uncommon combination—a mind equally artistic and scientific—is required to a less degree than before, and wider scope is given to the former capacity.

The consequence of this is, that the number of amateurs is now enormously on the increase. The man who has but a few summer days to spare may take up the camera and may work it with profit. There will probably be soon—if there is not now—an army of amateurs as great as there was twenty years ago. The ranks are continually being recruited, and greatly by those who have worked no other process before the gelatine one.

Now we come to the object of our “lessons.” How is the dry-plate aspirant, who takes up the gelatine process as his first, to gain the necessary information to enable him to practise the art? If he has a photographic friend—if his friend and he have coincident spare hours, and if his friend has the ability of conveying to others the knowledge which he himself possesses (an ability rarer than is generally supposed)—then the way whereby the would-be photographer is to gain his information is clear.

In very many cases, however, the beginner has no such

friend; then, where is he to turn? True, there are several excellent manuals published on the gelatine process, but most are quite unsuited for beginners; they presuppose a general knowledge of photography—at least, of the “wet process.” Then there are the directions contained in the boxes of plates which the tyro will purchase. They also are excellent in their way, but they are necessarily laconic—they, as well as the manuals, are addressed to those who already are not unacquainted with photographic processes. They constantly refer to the collodion process as a standard, and they use technical language which is unintelligible to the beginner. Let our general reader try to cast his mind back to the times when he was tediously wading through the beginning of whatever was the first photographic process he ever worked. Can he remember when terms now so familiar to him, such as “detail in the shadows,” “density in the high-lights,” conveyed no idea to his mind? Perhaps he cannot; but such a time there certainly was for each of us, and now is for every one who first attempts to solve the mystery of the language in which the modern dry-plate manuals and instructions in the plate-boxes are couched.

We know the case of many who have commenced photography since gelatine became popular, and who, feeling the want which we have attempted to explain—of anything to guide them to a direct knowledge of the working of dry plates—have familiarized themselves with the more difficult wet process for the sole purpose of using it as a stepping-stone to the former. In speaking of the gelatine process as easier than the collodion, it must be understood that we go on the assumption that the dry plates are purchased from the manufacturer, not made by the photographer himself. No beginner should attempt

to make his own plates. He will find that he has quite enough to do to learn to work those which are made for him by others. In fact, we consider that the most experienced photographer who is wise will buy his plates, unless he takes an actual scientific interest in the manufacture. Dry plates can now be had so cheaply that he can scarcely expect to save money by making them. This, however, is a digression. To return to our subject. What we intend to do is to give a series of lessons on modern dry plates, addressed to perfect beginners. We shall use no technical terms, or only such as we have already explained, and shall assume no knowledge of any photographic process.

Our endeavours shall be to give such instructions that those beginners who will follow them carefully may, without any other assistance, after a little practice, be able to turn out, with a fair approach to certainty, technically perfect negatives on plates purchased from any trustworthy maker. We shall avoid theory altogether, and we do not intend to enter into the question of art. All we propose to do is to teach the A B C of the subject—the purely technical. To the higher branches of photography—the artistic—the aspirant must be guided mostly by his natural gifts; but he will find much to assist him in many advanced books on photography; but we shall give short instructions in printing, so as to enable the student to complete his picture.

Our last lesson will consist of concise instructions for the making of an emulsion and coating of plates, so that the amateur who chooses, for pure love of so doing, to make his own plates, may do so. Here, again, we intend to avoid all theory, nor shall we enter at all deeply into the question of emulsion making, as the subject has been

very fully treated in two different manuals published by Messrs. Piper and Carter.*

We intend to devote a chapter to the subject of lenses, and to give a few very simple rules whereby the beginner may gain some idea of the exposure which will be required under different circumstances. It is common in manuals for beginners to say that knowledge of the length of exposure can only be gained by experience. This is partly true, but not entirely. *Some* idea may be given of how long the cap should be kept off the lens under certain circumstances, and this, we believe, will greatly assist the beginner. We remember ourselves how, when we commenced the study of photography, with no assistance but what we could get from the hand-books, we sought in vain for at least some faint clue to the length of exposure, and to the factors which regulated it.

* "Photography with Emulsions," by Captain Abney; and "Modern Dry Plates," by Dr. J. M. Eder.

CHAPTER I.

SELECTION OF APPARATUS.

THE first thing that the photographic beginner has to do, after he has made up his mind that he is going to take up the fascinating art-science, is to determine what size of "plate" he will work—that is to say, how large his pictures are to be. As a matter of course, he should begin work upon the smallest plates which he can buy, as the first few results are sure to be far from perfect, and the cheaper the plates spoiled the better. This does not, however, bind him to the smallest size. All photographic cameras are made so that several different sized plates will fit into them, and after the first difficulties are over, the tyro is sure to aspire to the production of something larger than the well-known "card" or carte-de-visite.

In considering size of plate to be worked, it must be borne in mind that the larger the plate the greater the weight to be carried into the field, the greater the difficulty of manipulation, and the heavier the expense at every turn. This being the case, we would suggest to our friends as a good size that known as "half plate"; this is a plate measuring $6\frac{1}{2}$ inches by $4\frac{3}{4}$ inches. This allows of pictures.

being taken of the popular cabinet size, and the apparatus necessary can very easily be manipulated in the field. A somewhat larger size can easily be carried by an active man; but we should recommend that, at any rate, nothing greater than "whole plate," or $8\frac{1}{2}$ inches by $6\frac{1}{2}$ inches, should be attempted. The smallest size of plate offered for sale is the "quarter plate," measuring $4\frac{1}{4}$ inches by $3\frac{1}{4}$ inches, and, as we have said, the beginner should confine himself to this size till he has become somewhat familiar with the different operations involved in the taking of a negative.

Having decided the size, the next thing to consider is in what manner to purchase the apparatus; and here we must say emphatically that the only way in which to be sure of getting reliable photographic requisites is to go to a first-rate dealer, and to purchase them new from him. There is a general idea in the mind of the non-photographic public, probably gained from seeing numbers of old cameras and lenses exposed for sale in pawn shops and such like, that great bargains are to be made in second-hand photographic apparatus, and that the beginner may "pick up" what he wants very cheaply by a little looking about. There can be no greater mistake. The experienced photographer may occasionally pick up an article very cheap; but the man without technical knowledge will be sure, if he attempts to do the like, to find on his hands goods which will be useless to him when he has somewhat advanced in his art.

Having thus advised our reader where to purchase his apparatus, there still remains the question, "How? Is it advisable to go in for a complete set, or to buy each article separately?" The beginner will be best advised in this matter by the state of his funds. The "sets" made up by

most of the chief photographic dealers are most excellent and complete; but the sum charged for them is greater than many are willing to lay out at once. These may buy at first only those articles which are absolutely necessary to begin with, and may add to their store from time to time, as they think fit. We give a list of the articles most necessary for working quarter plates, and afterwards shall say a word on such of them as seem to us to call for special description:—

A camera.

A lens.

A tripod stand.

Three flat dishes or trays of porcelain or other material.

A graduated measure, holding $\frac{1}{4}$ -ounce.

A graduated measure, holding 4 ounces.

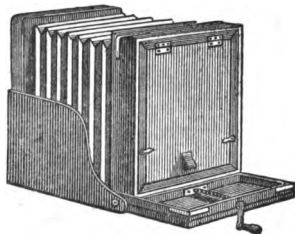
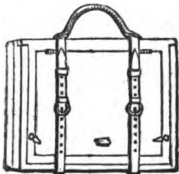
A dozen gelatine quarter plates.

A dark-room lamp.

A photographic camera is, as probably everyone knows, a sort of box, at one end of which is held the sensitive plate, and at the other end of which is held the "lens"—which latter throws an inverted image of any object in front of it on to the plate—and that there is a means of adjusting the distance between the lens and the plate, or of "focussing" the camera. Every camera has, besides this, a piece of ground glass, which can be put in the exact place to be afterwards occupied by the plate, and upon which the image can be seen so as to facilitate focussing. It is also fitted with a "dark-slide." This is a sort of case in which a sensitive plate may be fixed. After this camera has been focussed, the dark-slide is placed in the position before occupied by the ground glass, which latter is removable. The "shutter" or sliding door of the dark-slide is

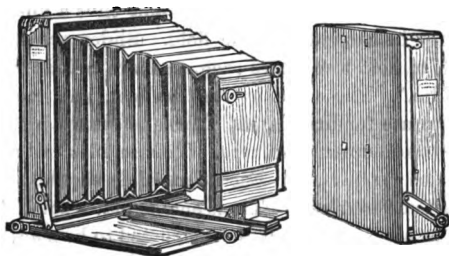
then removed, and, on taking the cap off the lens, the image falls on the plate. As many dark-slides as are desired may accompany a camera, and thus a number of plates may be carried into the field. Slides are also constructed to hold two plates each, and are called "double dark-slides." These are by far the best and most convenient to use for dry plates. Three slides are a common number to accompany a camera. This enables half a-dozen plates to be carried out. Each dark-slide should be fitted with a set of "carriers." These enable plates smaller than the largest size for which it is constructed to be placed in it.

All modern cameras for use in the field are made so that they can fold up into small compass for ease in carrying, and have "bellows bodies," that is to say, can be drawn out and in like a concertina. We illustrate two of the



best modern forms of camera, showing in each the camera as in use, and as folded down for transportation. In purchasing a camera, the photographer should get one which will open to a considerable distance—if possible, as much as twice the length of the largest size which it will work. In some part of his career the amateur is sure to aspire to the taking of portraits. His attempts in this direction are almost certain to be failures, and to cause

great pain to his friends, but nothing is surer than that the portraiture fit will attack him. When it comes to this,



he will find a camera which opens to a considerable length a great advantage.

There are various adjustments attached to modern cameras which, although of little use in the hands of the beginner, will be found of great convenience to him when he is more advanced. These are chiefly a vertical and horizontal adjustment of the front on to which the lens is screwed, and what is called a "swing back." This latter provides a means of varying to a certain extent the angle between the sensitive plate and the axis of the lens. A leather case, into which the camera and the dark slides can fit, should be provided. The lens is the next most important piece of apparatus, even if it is not the most important of all. As we intend to devote a special chapter to lenses, we shall not go much into the question just now, but shall merely advise that what is known as a "single achromatic" lens of such a length of focus as to enable the largest plate which the camera will hold to be covered should be purchased. The lens should be bought direct from some reputed maker. The particular form of lens known as the "wide angle landscape" lens is the best.

The tripod stand calls for little special remark. Its general form is known to all. In those of modern construction each leg folds into two, so as to make the whole more portable. The only requirements of the camera stand are that it should be light, should be easy to fit up and take down, and should be quite rigid when fixed up.

The flat dishes or trays—or, as they are sometimes called, flat baths—are for use in the operation of developing, fixing, &c., to be described in a future chapter. Such dishes, made of so-called porcelain, can be had for a few pence each, and we should recommend that such be purchased for quarter-plate work. When the photographer advances to larger sizes, he may indulge in the more expensive and more convenient dishes made of ebonite and other light material.

The dry plates can be bought from any photographic dealer. They are extensively advertised in the PHOTOGRAPHIC NEWS; but we cannot take upon ourselves to recommend one make in preference to another. We have found all excellent, the cheap as well as the more expensive.

The dark-room lamp will be described when we come to the chapter on the "dark-room."

CHAPTER II

CHEMICALS.

AFTER the photographer has provided himself with the necessary apparatus and plates, his first consideration must be the purchase of the chemicals which he will require to convert his plates into negatives. We give a list of those which he will need, stating after each about the quantity which we think it desirable that he should possess himself of at first. Afterwards we give a few words describing the general properties of each substance, but not entering into the chemical composition. Each chemical, whether liquid or solid, should be kept in a bottle, which should have the name distinctly labelled on it, if possible in print.

We ought to have enumerated in our last lesson, amongst the necessary apparatus, a small balance such as apothecaries use for weighing out medicines. This should be provided with the usual set of "apothecaries weights." The chemicals required are as follows :—

Pyrogallic acid	...	...	...	1 ounce
Ammonia of specific gravity .880	...	...	...	3 or 4 ounces
Bromide of ammonia	...	...	...	1 ounce
Sulphite of soda	...	...	...	4 ounces

Neutral oxalate of potash	...	$\frac{1}{2}$ pound
Sulphate of iron ... ..	...	$\frac{1}{2}$ pound
Citric acid ... ..	...	1 ounce
Hyposulphite of soda ... ..	...	1 pound
Alum ... ..	...	$\frac{1}{2}$ pound
Methylated spirit ... ..	...	$\frac{1}{2}$ pint
Negative varnish ... ..	...	A few ounces
Bi-chloride of mercury ... ..	...	$\frac{1}{2}$ ounce

A couple of books of test papers, one of blue litmus and one of red litmus.

Pyrogallie acid is a white, feathery, and extremely light body. It is exceedingly soluble in water. It is a powerful absorber of oxygen, especially when alkaline. When a solution of it has absorbed oxygen, it turns brown.

The ammonia used in photography is the strongest solution of ammonia which it is possible to make in water at atmospheric pressure. It is the well known hartshorn. It is a perfectly transparent and colourless fluid. It is powerfully alkaline. When the stock has been purchased, it is advisable to pour it at once into a bottle holding exactly double the amount of the ammonia, and to fill up the bottle with water. If this is not done, the stopper of the smaller bottle may be blown out by the pressure of the liberated ammonia gas when the weather is warm. This will destroy the whole, as, on exposure to air, the liquor ammonia rapidly becomes weaker from the ammonia gas escaping.

Bromide of ammonia is usually found as a white powder, looking very much like ordinary table salt. It is very readily soluble in water.

Sulphite of soda is a white crystalline body. It is readily soluble in water.

Neutral oxalate of potash is a white crystalline body.

It is readily soluble in water. It ought to have neither an acid nor an alkaline reaction ; but often that sold as neutral is somewhat alkaline.

Sulphate of iron or "copperas" is a greenish crystalline body. It is very soluble in water, but requires considerable time. Its solution decomposes very readily if it be at all exposed to the air, on account of its absorbing oxygen ; after this it is useless for photographic purposes. It should therefore be kept—after it is dissolved in water—in a closely stoppered bottle.

Citric acid is met with either as clear colourless crystals, or as a powder. It is soluble in water.

Hyposulphite of soda is a clear colourless crystalline body, and is somewhat deliquescent—that is, if left exposed to the air it becomes damp. It is readily soluble in water.

The alum used may be the ordinary alum sold by grocers, and may be either a potash or a soda alum. As it is intended to be dissolved in water, it should be bought in the form of a powder. It does not dissolve in very large quantities in cold water, and dissolves somewhat slowly.

Methylated spirit calls for no particular notice, as it is well-known to all. That sold as "finish" is not suitable for photographic purposes.

Bi-chloride of mercury is a whitish crystalline substance. It is sparingly soluble in water, and is strongly poisonous. It is commonly known as corrosive sublimate.

Negative varnish in appearance is very like the ordinary spirit varnish used for varnishing wood, but differs from it in the resins used to manufacture it. It can be bought from any photographic dealer. That sold as "dry plate negative varnish" is the most suitable.

The test papers are for discovering whether a liquid such as a solution of any salt is neutral, acid, or alkaline. To use

them, proceed as follows. Suppose you have a solution of whose condition as regards acidity or alkalinity you are ignorant. Dip a small piece of the blue litmus paper into the solution. If the paper changes its colour to red at once, or after a short time, the solution is acid ; if no change in its colour takes place, the solution is either neutral or alkaline. In this latter case, dip a piece of the red litmus paper into it ; you will now know its exact condition. If the red litmus becomes blue, the solution is alkaline ; if no change takes place, it is acid.

We have now enumerated and shortly described the necessary chemicals, and shall give instructions for mixing one or two of what are called "stock solutions." These are solutions which may be kept for some time, and which the photographer should always have by him. The ones we now describe are those to be used in the first lesson in development.

No. 1 bottle to be labelled "Solution of Oxalate of Potash" in large letters, so that it may be read in a very dull light. Place the whole half pound of neutral oxalate of potash in a bottle capable of holding from ten to twelve ounces. Fill up the bottle with warm water, place in the cork, and shake. A part, but not the whole, of the white crystals, will dissolve. The liquid will be what is called a "saturated solution"—that is, the water will have taken up as much of the salt as it is capable of doing. When any of the solution is used, the bottle should be again filled up with water, and this may be done repeatedly till all the crystals are dissolved, when more oxalate of potash must be purchased. This solution must be tested in the manner described above to discover whether or not it is alkaline. If it is, enough citric acid must be added to make it neutral or very slightly acid.

No. 2 is to be labelled "Sulphate of Iron Solution." Place about a half of the sulphate of iron in a half-pint bottle, and proceed exactly as with the last stock solution. It is very necessary in this case to keep the bottle always full of solution, and well corked, as the oxygen of the air, if it come in contact with the liquid, very rapidly spoils it. The solution should be of a bright green colour. If it get red, it is useless.

No. 3. *Ammonia-Bromide Solution.* *One per cent.*—Weigh out twenty grains of ammonia bromide. Place in a four-ounce bottle, and make up to four ounces with water. The percentage is not exactly correct, but is quite near enough for the purpose.

No. 4. *Alum Solution.*—Place three or four ounces of the alum in a pint bottle. Fill up with warm water. The whole of the alum will probably dissolve, but some of it will be thrown down again as crystals when the solution becomes cold. As long as these last, more water may be added from time to time, as the solution is used. When they are all dissolved, alum must be added.

No. 5. *Fixing Solution.*—Place five ounces of hyposulphite of soda or "hypo" in a pint bottle, fill up with warm water, and shake till all is dissolved.

Common tap water may be used for all these solutions, which, stated briefly, are as follows :—

No. 1. Saturated solution of oxalate of potash.

No. 2. Saturated solution of sulphate of iron.

No. 3. Ten per cent. solution of bromide of ammonia.

No. 4. Saturated solution of alum.

No. 5. Twenty-five per cent. solution of "hypo."

CHAPTER III.

THE DARK ROOM.

OUR young friends will understand that the plates which they are about to work with are of the most "exalted sensitiveness;" that is to say, a very small amount of light allowed to act on them will produce a change which may be made visible. We must explain, however, that it is, only certain rays of light which have the power of making the change which we mention. All our readers who have a little knowledge of physical science, know that white light is in reality a combination of light of all the beautiful colours which we see in the rainbow, and that if we pass a ray of white light through a prism, it will be broken up into all these colours. The order of them is—violet, indigo, blue, green, yellow, orange, and red. Those at the beginning of the list are called rays of high refrangibility, those at the end, rays of low refrangibility. Now, it is a curious fact that the photographic change which is worked in a sensitive plate is worked entirely by the rays of high refrangibility, principally by the violet and the blue, which are said to be "actinic;" whilst the red, which is said to be "non-actinic," has no effect at all. Were it

not for this peculiar fact, photography would be almost impossible, because we could find no light in which we could manipulate our plates without their being affected, and consequently destroyed. As it is, however, we only require to secure some place illuminated by those rays which do not have any photographic action, and we can work quite freely. In other words, we want a room lighted with only red light in which to work.

Photographers give such an apartment the name of "dark-room," although the term is a misnomer. In the dark-room, then, we propose to give what hints we consider necessary for the beginner.

It is scarcely to be expected that the young amateur, taking up the subject of photography for the first time, will have the power of obtaining the exclusive use of a room of considerable size, to convert into a dark-room; but, on the contrary, he will probably have to put up with some temporary arrangement; nor is it at all necessary even when he advances considerably that he should have a permanent dark-room unless he intends to make his own plates. Any room or closet from which all the outer rays of light can be shut off may be converted into a dark-room in which plates may be changed and developed. If a room having a sink and water tap—say the pantry—can be "annexed," the trouble will be greatly reduced; but it is quite possible to make shift with a pail for a sink, and a water jug instead of the tap.

We have said that it is necessary to shut out entirely all outer light. This pre-supposes the use of artificial light for illuminating the apartment with the necessary red or non-actinic light. We consider that until such time as the student sees his way to fitting up a permanent dark-room, he will find it best to work with artificial light. There

are lamps constructed especially for the purpose of giving "safe" light sold by all dealers in photographic apparatus. These use either gas, oil, or candles, and all consist of an arrangement whereby the air necessary to support combustion is introduced by passages which will not allow white light to find its way out, the colour of the light being modified by funnels of ruby glass, or shades of ruby paper or cloth. The gas and oil lamps are much to be preferred to the candle arrangements, as with the former it is possible to raise or lower the light at will.

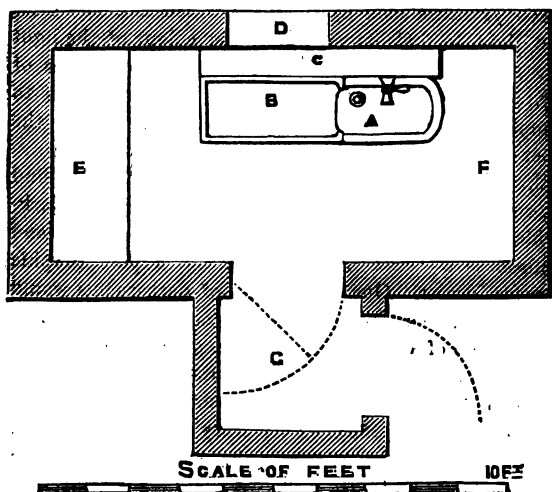
All, then, that the photographer has to do, is to find some small room or closet, which he can make quite dark, in which he can have a plain deal table to work upon, and to purchase a "dark-room lamp" from a photographic apparatus dealer. Our description of dark-rooms would not, however, be complete, unless we say something about the fitting up of a permanent photographic room in which all the operations, including the manufacture of the plates, may be conducted. We give here a sketch of such a room.

D is a window whereby the necessary light is introduced. It should be about two feet long, by one foot six inches high, and should be glazed with one thickness of ruby, and one thickness of orange glass. On the inside there should be a blind of red Turkey cloth, which can be raised and lowered at will. This is to reduce the amount of light when the sun shines direct on the window, or when the process of plate manufacture goes on.

A is a sink made of glazed stoneware. The top edge should be about two feet six inches, or two feet eight inches along the floor.

B is the operating table. It should be covered with sheet lead, should have a very narrow and low ridge round all the sides except that next to the sink, should have a very

slight incline in that direction, and should have the sheet lead "dressed" over the edge of the sink, so that all spillings may find their way into it.



C is a narrow shelf about four inches above the level of the table and sink, and extending along the whole length of both of them. On it is placed the lamp when artificial light is used, as when working at night, and the bottles of solutions actually used for development. The lower edge of the window should be an inch or two above this shelf. There should be a shelf about six inches below the operating table, on which the flat developing dishes may be kept.

E is a table on which the levelling slab may be placed when the manufacture of plates is commenced. Above it

—or, in fact, along all available space of the walls—shelves may be fixed for carrying bottles, &c.

A space is reserved at F for the drying cupboard, used in manufacturing plates. Above it, and with its lowest edge about three feet higher than the floor, should be fixed an ordinary cupboard, with a door closing light-tight. In this may be placed plates or anything sensitive to light, which would be destroyed if left about, for it must be understood that even light of the deepest ruby red will in time act upon a sensitive plate.

G is an arrangement of double doors, whereby the photographer may go out or in without letting any light enter.

Provision must be made for ventilating the room without letting in light. There should be at least one common gas jet for lighting up the room when no sensitive plates are about, so that solutions, &c., may be mixed with comfort, and there should be provision made for attaching several rubber tubes with the gas pipes for connecting with Bunsen burners, &c.

The photographer will in all probability not *build* a room, but will adapt one already built to his purposes. In this case he will have to exert his ingenuity to allot his space to the best purpose. We have enumerated all the appliances for which room ought to be reserved.

CHAPTER IV.

FIRST LESSON ON EXPOSURE AND DEVELOPMENT.

BEFORE giving instructions in the actual manipulation of developing a plate, we must define the terms negative, exposure, and development.

A negative may be said to be a pictorial representation of any object or scene which, on looking through it at a bright light, shows all the shades of nature reversed. Thus when we look through a negative of a landscape, holding it between us and (say) a gaslight, we see the sky and all objects which are in reality white, represented as black, whilst the darker parts of the landscape are represented by the bare and transparent glass. If the negative be a portrait, we see the face black, looking like a negro's ; whilst a black coat looks white, and so on. The negative is produced by the action of light in the camera, the places where the light has acted most strongly being turned black. The time necessary for the light to act on the plate to produce the required effect is called the exposure. Now, we have said that the light acts upon the plate and darkens certain portions of it, but it must be

understood that this action is not at first visible. A marvellously short exposure is enough to impress all the details of a landscape on a plate in such a manner that by acting upon the plate with certain chemicals, these details may be made visible. This operation is called development, and consists essentially in the strength of an image so faint as to be invisible to the eye, till it becomes as vigorous as we desire. Anyone, however unacquainted with photographic operations, will perceive that when once we have obtained a reversed picture, such as we have described, we have nothing to do but to place this in contact with a sensitive film, and allow light to act through the negative, when we shall have a picture with its shades true to nature. This latter process is performed with sensitive paper, and is termed printing.

Upon correct exposure and development, nine-tenths of the technical success of negative-making depends, and when once the student has thoroughly mastered the relation of the one to the other, half the battle will be over. He cannot do so without practice ; but we hope to give him such assistance in explaining the matter as may lead him to the desired end as quickly as possible.

Let the beginner select an object upon which he will make his first attempt. If he can resist the temptation to try a portrait, so much the better. A brightly lighted landscape, with strong contrasts of light and shade, is the best ; it need not be picturesque. A suitable view can generally be got out of some window, or a very suitable subject is a bust or statue placed either in a well-lighted room or out of doors. We shall suppose in the present instance that the landscape is selected. The camera should point neither towards nor away from the sun. If the sun shine direct into the lens, the plate will be destroyed ; if the

sun be directly at the back of the camera, the picture will look "flat."

Before beginning operations, we wish to explain what is the meaning of correct exposure. Let the student look attentively at the view which he has selected to make his first attempt upon. He will see that apart from the various colours represented, there is a very great range of light and shade. He knows that this range is brought about by the fact that different objects reflect different amounts of light to his eye. Probably the sky will reflect the most light, and going through the whole range from this he will see that there are a few little bits of the landscape that appear absolutely black. They do reflect some light, but it is so little that by contrast with the brighter objects they appear to reflect none. Now, let our student consider the process which goes on during exposure. He knows that when he has his camera with a dry plate in position, and when he has removed the cap of the lens, a perfect picture of the landscape, with all the shades of light, will be thrown on the sensitive film, and that the light will be acting upon it. Now it is evident the brighter parts of the picture will first take effect, and afterwards the darker, until the exposure has been prolonged to such a period that all the shades of light except those which, as we explained, appear in the landscape absolutely blank, will have impressed themselves. At this point the correct exposure has been given. Had a shorter time been allowed, some of the darker shades—or, as it is technically called, the detail in the shadows—would have failed to impress themselves, and the resulting negative would have been said to be under-exposed. On the other hand, had the exposure been prolonged, the light emanating from the apparently black parts of the landscape would have impressed the plate,

which would eventually appear to be darkened all over, and would be said to be fogged from over-exposure. It is said of a correctly-exposed negative, that it has all the detail in the shadows without being fogged.

Now we shall pass on to the practical exposure of a plate, and shall show the student how he can tell, by the behaviour of the plate during development, whether he has hit the much-desired correct exposure, or not.

He will require to light his dark-room lamp, and to get by him the three flat dishes, the two measuring glasses, all the stock solutions which we gave directions for mixing in a former chapter, and his box of dry plates.

Now let him place his camera in position, opposite the view to be photographed; let him remove the cap from the lens, and place his head under the focussing-cloth. Any thick dark cloth or shawl answers the purpose; or a piece of black velvet or macintosh, about two feet square. He should remove the stop from the lens entirely, if it has movable stops, or, if the stops be rotary, should turn them till the largest one is in use. This will make the image on the ground glass very bright, and, by turning the focussing-screw first one way, then the other, he will easily find in what position the image is the sharpest. When he has discovered this, let him place the smallest stop in the lens. We say the smallest stop, not because it is necessarily the best for the picture which he is going to take, but because it will enable him to give a comparatively long exposure.

Having his camera fixed and focused, let him place the cap on the lens once more, and retire to the dark-room with one of his double dark slides for the sensitive plates.

When once here, he must place the dark slide open in front of the lamp. Now, he must lower the light till there is only just enough to enable him to see. He must open

his plate box now and take out two plates—two glasses must be placed in the dark slide at once, but one may be a “dummy” if he happen to have but one dry plate; that is, either a clean plate or a spoilt negative. In placing the plates in the slide, let him be very careful that in each case the side of the plate which appears dull, on account of its having the sensitive film on it, is placed towards the outside. Now, having closed his dark slide and wrapped his plates up again, let the photographer return to the camera. He should carry the dark slide under the focusing cloth, for further security against light, and in placing the slide in the camera and during exposure should keep the whole apparatus under the cloth for the same reason. He now removes the focusing screen, and places the dark slide in the position occupied by it, keeping the side marked 1 towards the lens. He now withdraws the sliding door, which is the only thing which intervenes between the lens and the sensitive plate. He takes his watch in his hand, and removes the cap from the lens for (say) five seconds, replaces it, slides in the shutter of the dark slide, and carries the latter off to the dark-room. We have supposed any of the usual view lenses to have been used, the landscape to be brightly lighted, the time of year to be spring or summer, and the time of day morning or noon.

CHAPTER V.

SECOND LESSON IN DEVELOPMENT.

IN our last lesson we left the photographer at that stage where he had accomplished the exposure of a plate, and was about to commence the development. We should explain that the developer with which he is going to make his first experiment is that known as ferrous oxalate. When he has somewhat advanced, we should recommend him in all cases to use the exact developer recommended in the printed instructions contained in the plate-boxes. This will generally be that known as "alkaline pyrogallic," but the ferrous oxalate has the advantage of such extreme simplicity that it is most suitable for a beginner, and, mixed as we recommend it, is suitable for any commercial gelatine plates of which we have had experience.

The photographer has now, we shall suppose, returned to his dark room. He may lay his dark slide, still wrapped in the cloth, on a shelf, and, turning up the white light, make the following preparations. He lays his three flat dishes in a row along the front edge of the table, the one to the left opposite the red light, the others to the right of this one. We shall call the dishes Nos. 1, 2, and 3, beginning at

the left. Into No. 2 he pours two or three ounces of the alum solution ; into No. 3 about the same quantity of the "fixing" or "hyposulphite" solution. Now he takes the four-ounce measure, and pours into it exactly two ounces of the potassium oxalate solution. To this he adds half-ounce of the sulphate of iron solution. The whole will immediately assume a beautiful ruby red colour ; to it he adds about 20 minims of the one per cent. solution of bromide of ammonium. He will now have about $2\frac{1}{2}$ ounces of developer. This is an extravagant amount to use for a quarter-plate, and, if the photographer continues to use ferrous oxalate, he must reduce it to one-half ; but at first it is best to use a good dose. Everything is now ready. The white light must be entirely extinguished, and the red light lowered as much as possible, till there is just enough to see by. The plate which has been exposed must be carefully removed from the dark-slide, and laid—film side upwards—in dish No. 1, which is still empty. Now the dish with the plate in it is taken in the left hand, and the measure with the developer in the right. The developer is poured rapidly, but gently, over the plate, the dish being waved or rocked to make the liquid cover any corner which it may incline to avoid, and the whole is placed again in front of the red light. And now (if everything has been rightly done) will commence one of the most wonderful of the phenomena of science or nature which man has been given the power to control—a phenomenon which is always new and always beautiful—the "development of the latent image." Let the beginner watch it closely. The plate had no indication of having been acted upon at all before the developer was poured over it. After, perhaps, ten or twenty seconds there is a slight darkening of some part. When this becomes dis-

tinctly visible the light may be somewhat raised, for the plate has become less easily affected by it. It will now probably be seen that the brighter parts of the landscape have become quite visible. In *negative*, be it remembered. The sky will be represented by blackness. Now is the time when we can tell whether or not the exposure has been correct. If it has been, the development will progress with beautiful regularity. The bright parts (or high-lights) appear first; then slowly, but steadily, more and more of the half tones, or less brightly lighted parts, come out; and at last every object and shade except the deepest shadows have their counterpart in the negative. In other words, the plate should be darkened to a greater or less extent in all parts except those few which represent the part of the landscape which appears to the eye quite black, and this should come about in between one and two minutes. If the plates have been under-exposed it will be longer before the high lights appear, and very soon after they do the action will stop, no more detail coming out, but large patches of the plate remaining white as before. If, on the other hand, it has been over-exposed, the high lights will appear a little sooner, and almost immediately afterwards the whole of the plate will be covered with detail, no part remaining white.

The final result of incorrect exposure is, with under-exposure, a hard picture with contrasts over-marked, and with deep heavy shadows in which none of the detail which is visible to the eye is represented; with over-exposure, a flat, uninteresting looking production, showing all the detail which there is in the original, but lacking the bold contrast of light and shade.

We shall suppose the happy medium to have been hit, if not at the first attempt, after a few more plates have been

exposed. The development is not of necessity finished when, looking on the surface of the plate, all action seems to have ceased. We have still to wait till the "density" is sufficient.

A little reflection on the principles involved in the process of printing which we briefly described in a former lesson will show that not only is it necessary for the production of a harmonious picture to have all the details which are in the original represented, but in the negative these must be represented by a certain definite amount of opacity, or, as it is usually called, density. It must be understood, then, that as long as the plate lies in the developer, even after looking down upon it, all action seems to have stopped, the density continues to increase, and we may say at once that the most difficult thing of all to judge of in gelatine dry plate work is when the required density is gained. So difficult is this, that even the most experienced photographers may occasionally fail. The reason of this is that the after processes very much modify the apparent density of the negative, and not only that, but in every different make of plate the apparent density is modified to a different degree. We must make it appear far denser than it is eventually to be. It is only by experience that knowledge approaching to exactness can be gained on this point. When we come to the lesson on printing, we shall explain more fully the characteristics of an over dense, and a "thin" or under dense negative. Just now we will merely indicate the manner in which it is usual to judge of the density. The red light must be turned pretty high. The plate must be lifted from the developer and held, with the film side towards the observer, for a second only, close to the light, and between the light and the photographer. He must rapidly judge whether or not the density is correct.

We may say roughly that, as a rule, the densest parts should appear almost, if not quite opaque. If they do not, the plate must be returned to the developer.

We shall suppose the correct density to have been gained. The time taken with the developer we have given will probably be from two to five minutes. The developer is now poured back into the measure. If used within an hour or so, one or two more plates may be developed with it. The plate is now thoroughly rinsed under the tap, either held in the hand, or left in the flat dish. After this, as much red light may be admitted as is required. Then the plate is laid for five minutes in the alum solution, to harden the gelatine film. It is again thoroughly rinsed, and placed in the fixing solution. It will have been observed that up till this time the plate, looked at from the back, still appeared white. This is because the sensitive salt of silver which was not acted upon by light still remained in the film. On placing the plate in the hyposulphite, this whiteness will gradually vanish. When there is no farther appearance of it from the back, white light may be freely admitted. The plate must still be left a few minutes in the fixing solution, after which it must be most thoroughly washed. It should remain at least half-an-hour either under running water or in frequent changes of clean water. After that, it is reared up on edge to dry, when the negative is complete. Heat must on no account be used in drying.

The method of comparing lenses—and which applies to all lenses—is as follows. State the ratios between the apertures of the lenses and the focal lengths of the lenses as fractions—the aperture as the numerator, the focal length as the denominator. Square the fractions thus obtained, and the resulting figures will give the ratios of the rapidity. It is usual to state the fractions thus: $\frac{f}{1}$ $\frac{f}{16}$ $\frac{f}{40}$. These fractions refer to lenses the first of which has an aperture one-fourth of the focal length, the second one-twelfth, and the third one-fortieth. We shall take a practical example. We are using a portrait lens 10-inches focus, and aperture $2\frac{1}{2}$ inches; that is, the focal length is 4 times the aperture, or we say the lens is working at $\frac{f}{4}$. The focal length, be it remembered, is the distance between the diaphragm and the ground glass. We now substitute a single lens of 12-inch focus with a stop $\frac{3}{4}$ -inch in diameter. The aperture is now $\frac{1}{8}$ of the focal length. The lens is working at $\frac{f}{8}$; square these two fractions, thus:—

$$\left(\frac{1}{8}\right)^2 = \frac{1}{64} \quad \left(\frac{1}{16}\right)^2 = \frac{1}{256}.$$

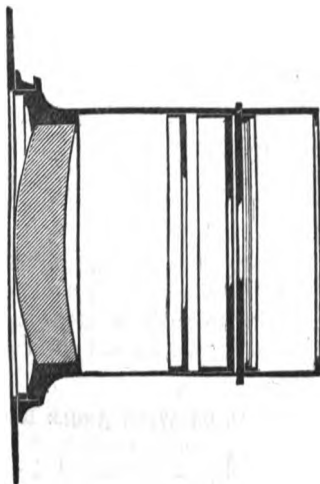
The rapidity of the lenses is as $\frac{1}{16}$ to $\frac{1}{256}$. The exposure required will therefore be as 16 to 256, or as 1 to 16. Thus, if we had been giving two seconds with the portrait lens, we should have to give thirty-two seconds with the single lens. If the beginner will exercise himself in this rule for a little time, he will find that he soon gains wonderful facility in applying it, and he will find that it gives him a very great power in estimating the necessary length of exposure. With the same lens and different stops the rapidity varies as the square of the diameter of the stop, or as the area of the stop.

We shall now go rapidly over the different kinds of

lenses most in use, giving the purposes for which each particular form is best adapted.

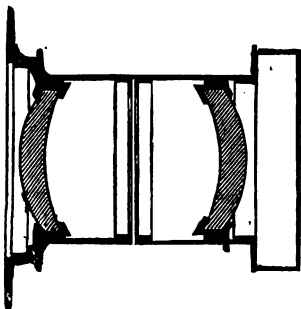
We have first

THE SINGLE LENS.



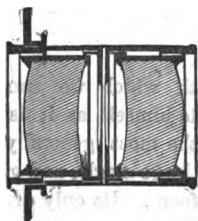
It is the one with which we should recommend the beginner to provide himself, as it is the simplest form of lens, and is also the most generally useful. It is fairly rapid, has a fairly large angle, and gives wonderful definition and depth of focus. Its only drawback is that it gives slight distortion. If, for example, it be attempted to photograph a building of large size with it, the boundary lines will appear slightly curved, and the building will appear barrel-shaped.

THE RAPID RECTILINEAR OR RAPID SYMMETRICAL



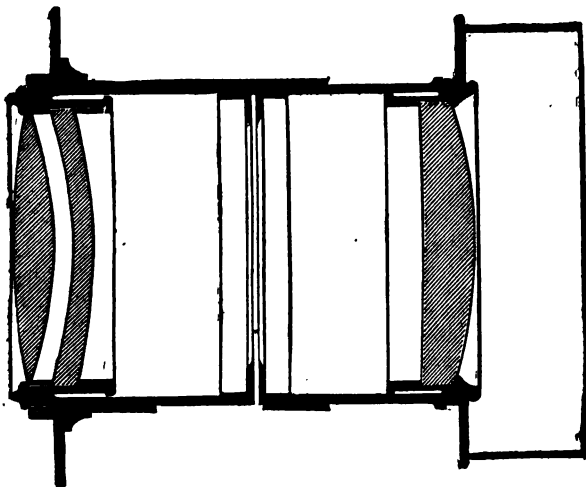
is one of the very most useful of lenses. It is very rapid, and one should be purchased when the photographer has so far advanced as to wish to attempt instantaneous effects. It gives no distortions, and about the same angle as the single lens.

THE SYMMETRICAL OR WIDE ANGLE RECTILINEAR



is a very slow lens, but takes in a wonderfully wide angle, so that it is useful for photographing objects when it is impossible to get the camera far enough away from them to use the rapid rectilinear. It is quite free from distortion.

THE PORTRAIT LENS



is intended for portraiture pure and simple. The utmost ingenuity has been spent in the case of this lens to get the greatest possible rapidity, but many other good qualities have been sacrificed. Thus the field is round, the marginal definition bad, and there is very little depth of focus. For its own particular purpose it is, however, admirably adapted. With the very rapid plates which can now be had, it is quite possible to take portraits even indoors with the rapid rectilinear or the single lens, and we would not advise the beginner to purchase a portrait lens.

There are numerous photographic lenses sold under

names different from any of the above, but all of them will be found to be very similar to one or other of the kinds described. As we are entirely avoiding in these lessons all historical reference, we shall not say anything of these forms of lenses, which have now gone out of use, and are not now manufactured.

CHAPTER VII.

THE MANAGEMENT OF THE CAMERA IN THE FIELD.

If the young photographer have diligently perused the former lessons, and have gone through the various manipulations which are described in them, he will now be ready to sally forth into the field, and, selecting the beauty spots of nature, transcribe them by the aid of his camera and lens. He may, in fact, make pictures.

We have declared our intention of not entering into the question of art in connection with photography, but have referred our readers to more advanced works for guidance in this direction. Yet we may make a few general remarks on the subject, especially in indicating those points wherein the requirements for a photographic picture differ from those for a painting. The chief of these is, of course, the absence of colour. We cannot have transcribed by the camera the broad contrasts which are frequently brought out by colour alone. We must trust entirely to form and to light and shade. Very frequently a scene will make a most perfect picture on the camera ground glass, when the experienced photographer knows it

will make nothing in the print. Alas! the colour which makes the picture cannot be reproduced. This fact makes it the more necessary in the camera picture to have the form and light well balanced. The picture must not be all on one side, nor must there be running through it in any direction long uninterrupted lines. For the rest, there is wanting to a perfect landscape picture—be it painting, drawing, or photograph—a foreground, a middle distance, and a distance. It is in the latter that photography fails. What to the eye appears a definite distant landscape, the distance but lending enchantment and softness, comes out in a photograph so dim and faint, that it would seem to be almost hidden by a thick mist. The slight haze which, in this country at least, always stands between us and the distance, is exaggerated so as almost to obscure those things which are quite clear to the eye. A certain amount of haze covering distant objects is necessary to give the idea of distance, but the exaggeration of fog, mist, or haze, which the camera always gives, is more than natural.

Perhaps the greatest difficulty in photographing, however, is that the sky is not, as a rule, rendered at all. An exposure which will suffice to bring out all the detail in a landscape is such that the sky will be so over-exposed as to show no trace of clouds. It is necessary, to get the sky, to make a special exposure, perhaps about one-tenth of that required for the landscape, and to resort to a "double printing" process, which it is without our province to describe.

The subjects best suited for the camera are of the nature of the following. Any landscapes having, apart from colour, broad and well marked contrasts of light and shade, and decided outline of form, are specially suitable. Trees of all kinds are well rendered, both with and without their leaves ;

in the former case, the difficulty is to get them motionless. A quiet windless day is necessary. Architectural subjects of all kinds are most perfectly reproduced by the camera.

The most charming effects of all are, perhaps, produced in a scene in which there is water—a quiet pool with reflections of trees, for instance.

We will suppose our pupil has determined on some locality where he is sure to find subjects such as those we have indicated. We shall follow him, indicating how he should act as he proceeds. First, he has to fill his slides. We will suppose he has three of these; they must be packed into a case which should be made to hold them and the camera. Besides these, he must take his lens, his tripod—and let him be most careful not to leave the screw behind him—his focussing cloth, and possibly a “focussing magnifier.” This is a small eyepiece to magnify the ground glass image, and enable him to focus with precision. It is useful mostly because it increases the light. When a small stop is used the ground glass image is frequently so dull that it can barely be seen.

Arrived at the scene of action, the photographer must select his point of view most carefully. Let him be in no hurry. Frequently a picture will be made or spoiled by altering by a few yards the position of the camera. When he is quite sure of his point of view, let him unfold his camera, erect it, and place it opposite the scene to be depicted.

A few words on the management of the tripod stand. With the beginner this is apt to prove most wonderful and fearful in its movements. The effect of moving any one leg appears to be the exact opposite of what might have been expected. After long struggles the whole apparatus assumes an appearance of hopeless inebriation, and finally

collapses, very possibly pinching severely the tyro's fingers between the tail-board and one leg. Let the stand be, however, once for all placed on the ground with its three legs about equally far, and a good distance, apart, and with one of them pointing towards the middle of the scene to be photographed, and all trouble will cease. There will be room for the photographer to focus comfortably standing between the back legs. To tip the camera up, all that is necessary is to draw the forward leg towards him; to tip it down, he need only push it from him. He may still further tip it up by spreading the back legs apart; and down, by bringing them together.

When the camera is fixed, and the view focussed, it will probably be found that there is too much foreground, and too little sky. Now, one of two things may be done. The camera may be "tipped" up. In this case, if there be any parallel vertical lines in the picture, they will be made to converge at the top, and it will be necessary to bring the swing-back into play, so as to make the ground glass once more vertical. If there be no vertical parallel lines, the camera may be tipped a little without appreciably modifying the result. The camera front and lens may be raised. This is usually the best course to adopt. The use of the swing-back always *strains*, so to speak, the lens, and necessitates the use of a very small stop. Raising the lens also strains it, but to a less degree. Tipping the camera does not at all. Most cameras are made so that either a vertical or horizontal picture can be taken, and judgment must be used to determine in which position it shall be. All the points above indicated having been considered, and the picture being all on the ground glass—proceedings so far having been conducted with open aperture or a large stop—the final focussing must be done. The principal object—generally in the middle distance—must be made

absolutely sharp. Now, stops smaller and smaller must be tried till the distance is *just sharp*.

Now all is ready for exposure. Let plate No. 1 be exposed first, and on no account let any plates be exposed other than in their correct order, else the photographer will be likely to expose two views on the same plate. A much more aggravating thing he cannot do. In exposing, procedure is exactly as described in a former chapter. We shall try to give a general idea of the length of a few exposures.

We described fully in the last chapter the means of comparing the rapidity of different lenses and stops. The student ought, therefore, to be able to make the necessary estimation for the particular stop he is using.

With a good spring or summer light and "open landscape" (that is, a view having no objects with very heavy shadows in the foreground), and with the average of rapid commercial plates, the exposure with $\frac{1}{10}$ will be from one to two seconds; with river scenes or seascapes, it may be reduced to one-quarter of a second—about the shortest possible to give by hand. With heavy shadows or dark-coloured trees it may run up to four or five seconds, and, in the shades under trees, even up to minutes. In interiors, such as churches and cathedrals, it is very much longer, even when they appear well lighted. Four or five minutes is a short exposure for an interior with $\frac{1}{10}$, and even when the eye can penetrate to every corner of the building, exposures of several hours may be necessary.

We should say that, for a landscape, the most pleasing lighting is usually a side-lighting. The lighting looking towards the sun is sometimes very pleasing, but care must be taken not to include the sun itself. This must be either to one side or above the picture, or may be kept out of it by the camera being placed in the shadow of a tree or some such object.

CHAPTER VIII.

THIRD LESSON IN DEVELOPMENT.

IN our last lesson on development, we considered the ferrous oxalate developer only, this being, as we have said, the best for a beginner. There are some who prefer this developer to any other, even after long experience: but the vast majority of photographers find qualities in the so-called "alkaline pyrogallic" developer which seem to be wanting in the others. The most notable of these is the power to compensate for a certain error in exposure.

In considering the subject of exposure in a former lesson, we assumed that correct exposure is a fixed point, and that any deviation from it would give imperfect results. This is not the case, however, for there is a certain "latitude," which is due to two causes: first, a certain latitude of effect is permissible. Thus, if the plate be a little under-exposed, there will be somewhat less detail in the resulting picture than is visible to the eye, but this need not spoil the effect. Again, if the plate be somewhat over-exposed, the effect will be a slight fog or want of transparency in the shadows of the negative; but the only result of this will be that what is called a "slow printing

negative" will be produced. The latitude in effect is not great, however. It may be said that if two seconds be the best exposure, anything between one and a-half and four seconds will give good results. We have, however, a second method of gaining latitude, and this is by means of the treatment with the developing solutions. Thus, simply by leaving the plate for a longer or shorter time in the developer, we can compensate to a certain extent for under or over-exposure. It is, however, by varying the proportions of the ingredients of the alkaline developer that we gain the greatest latitude. We must enumerate the chemicals used in this developer, and try to make clear what are the properties of each one of them.

The essentials are as follows :—First, pyrogalllic acid, or more properly, pyrogallol; second, liquid ammonia, or occasionally some other alkali; third, a soluble bromide, usually bromide of ammonium or of potassium.

The pyro. is the true developer, and acts very energetically when rendered alkaline. The stronger the developer is in pyro., the denser will be the negative; but the effect of increasing the pyro. is to "restrain" development—that is, to make it take a longer time, and to prevent a certain amount of detail from appearing.

The ammonia is used to render the developer alkaline, and the greater the quantity in the solution, the more energetic the action. The effect of increasing the ammonia is to shorten greatly the time of development, to increase to a slight extent the amount of detail, and to increase the density. A point is reached, however, where the action is so energetic as to reduce or blacken even those parts of the plate which have not been acted on by light, and fog is the result. Some plates will stand much more ammonia than others.

The use of the bromide is to retard development—to make it slower, so that it may be more under control. Without it the development is very rapid, and unless the quantity of ammonia be very small, it is difficult to avoid fog. The result of increasing the bromide is to make the developer much slower, to keep back a little of the detail, and to increase ultimate density greatly.

A little consideration of what we have said will show that by varying the proportions of the constituents we have enumerated we have the power of greatly modifying the resulting negative, and have a power of compensating to a great extent for error in exposure. This is especially the case for over-exposure. It is true that in the case of under-exposure we can correct to a certain extent by using an increased quantity of ammonia; but the fog point is soon reached, and thus it is only to a small extent that we can correct in this direction. In the case of over-exposure, however, it is different. Either pyro. or bromide may be increased indefinitely. The latter is the best to increase, as it is the cheaper. By largely increasing the quantity of bromide the development is rendered slow as regards the appearance of detail, but less so as regards the increase of density. It is thus possible to stop the process in the case of an over-exposed plate before the shadows veil over, and yet to have a sufficiently dense negative.

We have said that it is right, in using any particular make of plates, to use the developer given in the "instructions;" but it is by no means necessary to mix the "stock solutions" exactly as directed. On analysing any of the sets of stock solutions given, it will be found that they consist essentially of the three chemicals mentioned before made up in solutions of certain strengths, and generally with some preservative in the case of the pyrogallie solution to

prevent its turning brown by oxidation. In almost every case there is a most needless complication introduced which makes considerable calculation necessary to find what quantity of each chemical really is in an ounce of the final developer. There can be no simpler plan than to mix three solutions each containing ten per cent. of one of the three ingredients. The developer can then be made up in any proportion without trouble, and the developer given in any instructions can be used without the intervention of complicated formulæ.

We recommend that the solution be mixed in the following manner:—

Dissolve quarter of an ounce of citric acid in eight ounces of water. Add this to one ounce of pyro. Make the whole up to ten ounces, and label "Pyro solution."

Take one ounce of bromide of ammonia and make up with water to ten ounces. Label "Ten per cent. bromide solution." Take one ounce ammonia, strength .80, or two ounces of the ammonia diluted with an equal amount of water as recommended before, and make up with water to ten ounces. Label "Ammonia 10 per cent. solution."

There is no developer which is suitable for all subjects. Those given in instructions can only be taken as typical. If the photographer expects to excel, he must vary his developer to suit his subject. Thus, when the contrasts are very strong—say in the case of an interior with white columns and deep shadows—he must reduce the amount of pyro., or he will have a negative giving a "chalky" print.

If the contrasts are naturally weak, as is sometimes the case in open landscape, he must increase the quantity of all the ingredients, but specially of the pyro. and bromide. If he knows that he has under-exposed, he must increase

the ammonia. If he knows that he has over-exposed, he must increase the bromide.

The following we have found to be a good developer for general purposes :—

Pyro	...	...	...	from 1 to 2 grains
Ammonia	...	...	...	3 minims
Bromide	...	...	...	... 1½ grains

To each ounce of developer.

This is a more restrained developer than is usually recommended. We find, however, that the increase of the bromide beyond that commonly used does not necessitate an appreciable increase in exposure, whilst it gives a better quality of negative, and permits of a considerable latitude in exposure simply by allowing the plate to be a longer or shorter time in the developer.

We shall now tell how the best result can be got from a plate when there is uncertainty as to whether or not it has had the correct exposure.

A developer made as follows should be flowed over the plate :—

Pyro	...	1 to 2 grains according to subject
Ammonia	...	... 2 minims
Bromide	...	... 1½ minims

To each ounce of developer.

This is a very slow developer, and even if the plate be much over-exposed, the image will not appear for some time. A little experiment will enable the photographer to know whether the plate has been over-exposed, correctly exposed, or under-exposed by the length of time which elapses between the time of pouring on the developer and the appearance of the image. If the exposure

appear to be correct, let one minim of ammonia be added to bring the strength up to that recommended. If it appear to be over-exposed, let development proceed, or even add more bromide. If the image be very long of appearing, showing that there has been under-exposure, ammonia may be added to any amount short of that which will produce fog.

Good plates should stand ten minims of ammonia with one and a-half grains of bromide. The greater the quantity of bromide, the larger the amount of ammonia that may be used; but the quantity of ammonia permissible is not proportionate to the bromide used. Doubling the quantity of bromide will not permit double the quantity of ammonia to be added.

With the ferrous oxalate developer, under-exposure and over-exposure may be corrected to a certain extent, but not so greatly as with the alkaline developer. The developer may be accelerated by the addition of any quantity up to ten minims of a 1 per cent. solution of hyposulphite of soda to each ounce of developer, or retarded by the increase of bromide.

It is commonly said that there is difficulty with gelatine plates in getting a sufficiently dense image. Such a difficulty results from ignorance of the principles of development. The secret of getting "plucky" negatives lies in using an alkaline developer strong in all the constituents, but specially so in bromide, and, if necessary, giving a slightly longer exposure than might otherwise be thought necessary. The real difficulty lies in judging when the density is sufficient.

CHAPTER IX.

DEFECTS AND REMEDIES.

THE photographer is sure not to practise the gelatine dry plate process very long before he comes across some of the defects which are peculiar to it. We intend, therefore, to describe these as accurately as we can, and, where possible, to give a means of either preventing the occurrence of the objectionable phenomenon, or of curing it when it has made its appearance. Where the error is of a kind due to the preparation of the plates, we shall not enter into the cause of it, but merely indicate the cure.

General Fog.—This is probably the commonest of all faults with gelatine negatives. It consists of a veil over the whole plate, showing itself by want of transparency in the shadows. It may be so slight as to be imperceptible, except when the negative is laid face downwards on a sheet of white paper, or may be so dense as to make the time necessary to get a print be measured by days. It is due to one of two causes, which are usually indicated by the names, *chemical fog*, and *light fog*.

The first arises from error in the preparation of the plate. By it is meant that the sensitive film is in such a

condition that the silver salt is reduced by the developer without light having acted upon it. In certain cases it may be cured by soaking the plates before exposure in a solution of three grains of bichromate of potash to each ounce of water, afterwards thoroughly washing the plates, and then drying them.

To distinguish chemical fog from light fog, the best way is to develop an un-exposed plate, performing all the operations in total darkness. This is not difficult. If the plate be found to have darkened, the fog will be chemical fog, or, what is practically the same thing to the photographer, light fog, brought about by the action of light on the emulsion whilst in the hands of the manufacturer.

With the well-restrained developer which we gave in the last chapter, chemical fog is less likely to make its appearance than in the case of the feebly-restrained developers usually recommended. The bromide in the developer may even be increased beyond that which we give, but this will necessitate a somewhat longer exposure. We may state that bromide of ammonia in the developer begins to have an appreciable actual slowing effect on the plate when it is used in the proportion of $\frac{1}{4}$ or $\frac{1}{2}$ the quantity of strong ammonia used. When the bromide equals the ammonia, the slowing effect becomes very great.

Light Fog is due to the action of light generally in one of three ways : first, on account of an unsafe light in the dark room ; secondly, on account of a defect in the camera or dark slide admitting light ; and thirdly, on account of over-exposure.

When the fog is due to light in the camera, this will be recognised by the fact that the portions of the plates covered by the wires or rebates of the dark slides remain free from fog. When this is the case, the camera must be

carefully examined by removing the focussing screen, and looking for any the smallest defects which might admit light, the head of the observer being covered with the focussing-cloth. Light finding its way through defects in the slides generally shows itself in the form of streaks or lines. Should no defect be detected, the exposure must be reduced.

If fog from unsafe light in the dark-room be suspected, place a plate in the dark slide, draw out one of the shutters half-way, and then lay the slide for five minutes on the table where the plates are changed and developed; then develop the plate. If one-half darkens, it shows that the light is not safe, and steps must be taken to render it so.

Green Fog.—This defect is always due to error in the manufacture of the plates. It makes its appearance only in the shadows of the negative. If the negative be looked at by reflected light, a black object being laid under it, the shadows will be seen to be bright green. On looking through the negative they will appear somewhat pink, or sometimes a sort of "muddy" colour. Green fog makes its appearance only with alkaline pyrogallic development, and then chiefly when the plate has been under-exposed and development "forced."

A slight amount of green fog is not detrimental to the printing qualities of a negative; but if the defect shows itself in an aggravated form, the best means of preventing it is to resort to ferrous oxalate development. Captain Abney has recently given a means of curing plates afflicted with green fog after development. It consists of bleaching the negative with a solution of ferric bromide, oxalate, or chloride, and afterwards applying the ferrous oxalate developer. Full particulars of the method will be found in the PHOTOGRAPHIC NEWS for April 28, 1882.

Red Fog seems to be an aggravated form of the last-mentioned disease. In appearance it is a deep red deposit showing itself by transmitted light in the shadows of the negative. It is rarely met with at the present time, although it was common in the early days of gelatine plates. It does not make its appearance in plates developed with ferrous oxalate. Probably Captain Abney's cure for green fog would correct this defect also.

Frilling consists in an expansion of the film to such an amount that it loses its adhesion to the glass, and "frills" off. The phenomenon begins at the edge of the plate, and spreads towards the centre. When it begins at the centre it is termed blistering. It is due to an error in the manufacture of the plate, but is much aggravated by a developer strong in ammonia, by the use of warm solutions, by the use of too strong a fixing bath, or by the use of very soft water for washing. When it makes its appearance only in the fixing bath or during washing, it may be prevented with certainty by placing the plate, immediately after development, in a saturated solution of alum for five minutes. This we advise in all cases; but where there is no fear of frilling, the plate should be thoroughly rinsed before it is placed in the alum solution.

If the frilling be of so aggravated a form as to show itself during development, it is more difficult to prevent its occurrence. Captain Abney states that coating the plates with plain collodion before development is a perfect cure.

Plates which, when newly prepared, frill frequently, after keeping for some weeks or months in a dry place, show no tendency to the defect. In fact, we have found that the keeping of the gelatine plates for some time improves them in every way.

Want of Density or Flatness of Image is usually due to under-

development, or to the use of too weak a developer. A consideration of our remarks in the last chapter on development will show how sufficient density may be gained in almost any case ; and we may here say that a very common cause of want of vigour is to be found in the fact that the ammonia is not so strong as is supposed. In the case of liquid ammonia of specific gravity .880 a very short exposure to the air weakens it, by allowing ammonia gas to escape. It will be generally found that the last of the ammonia in a bottle is considerably below the standard strength, simply from the escape of the gas every time the bottle is opened. It is for this reason that we recommended the dilution of the ammonia with an equal bulk of water immediately after purchasing it. Pouring the strongest ammonia from one bottle to another will perceptibly weaken it.

There are some plates which will not give a vigorous negative, however they be developed. This is the case with plates on which the emulsion has been too thinly spread. If such plates are to be used at all, an after-process of intensification must be resorted to. This we propose to treat of in the next chapter. It will occasionally happen, too, with the best of plates, that an error of judgment will be made in development, and the process stopped before density is sufficient. This is another case for intensification.

CHAPTER X.

DEFECTS AND REMEDIES.

At the end of the last chapter we described the conditions which give rise to the occasional necessity for intensifying a negative. The term almost explains itself. It means the increasing of the density of a negative. A good intensifier will increase the density of every part of a negative proportionately; that is, when there is, after fixing, clear glass as in the shadows, no darkening will take place there, but every grade of density, from the finest detail to the densest high light, will be increased in a proportionate degree. The process ought to be thoroughly at the command of the operator, who should be able to produce any desired increase of density.

We may say at once that there is no thoroughly satisfactory intensifier for gelatine negatives, and that such a thing is a great desideratum. It is not within our province to enter into the discussion as to which is the best of the various more or less imperfect methods which have from time to time been published, but we shall give a formula which has at any rate the advantage of simplicity, and which will be found to give fairly good results. It is

one of the "mercury" intensifiers. It has two drawbacks. First, the results are not always permanent. Second, there is great difficulty in regulating the amount of intensification given by it.

The first objection is much lessened, however, from the fact—not, we believe, generally known—that when a mercury intensified negative fades, it can generally be brought back to its original condition by performing again the process of intensification. We shall suppose that a negative on printing is found to give a poor-looking print, lacking contrast. Let the following solution be prepared :—

Bichloride of mercury	...	...	1 ounce
Water	...	...	10 ounces

The whole of the bichloride of mercury will not dissolve, but the residue may be left in the bottle, and as the solution gets low through necessary waste, water may be added.

Let the negative be very thoroughly washed. Let it be placed in a dish, and let the mercury solution be poured over it. It will gradually become whitened or bleached. When the film is bleached throughout—as indicated by its being white at the back—let the solution be poured back into the bottle, and let the negative be most thoroughly washed. On the thoroughness of this washing seems to depend to a great degree the permanency of the results.

The negative has now to be treated with ammonia solution, which will blacken it, but the strength of the ammonia solution must be varied according to the amount of density required. Thus, if the print got from the negative previous to treating with mercury was very nearly up to the mark, a very weak solution of ammonia must be

used; one or two drops to the ounce of water will be enough. This solution is poured over the negative, and it will be seen gradually to darken. When all action ceases, the process is complete. The negative will now be of a curious orange tinge by transmitted light. If, on the other hand, the negative was one giving a very shadowy print, a solution of ammonia of one to twenty may be used. On this being poured over the plate, darkening will take place almost instantly, and the result will be a fine black-coloured negative.

Too great density of image is a fault sometimes met with. It is always due to error of judgment in development. It may be corrected by performing the first part of the process for intensification. This method is objectionable, however, as the results may not be permanent. A better plan is to immerse the negative, after fixing and washing, in a solution of one part of eau de javelle to three or four of water. After the desired amount of reduction has taken place, the plate should be again fixed and washed.

Spots of various kinds are liable to be found in the finished negative. They are of various forms, and are produced in various ways. Minute transparent spots or pinholes are caused by dust on the plate during exposure. The plate should be brushed with a broad camel's hair brush before it is placed in the slide.

Small transparent spots with irregular outlines are due to defect in the manufacture of the plate, and cannot be corrected by after manipulation.

Small transparent perfectly circular spots, with well-defined outlines, are due to air-bubbles in the developer, and are only produced when too small a quantity of developer is used. Air-bubbles do not, as is commonly supposed, form on the surface of the plate under the surface of

the developer ; they form on the surface of the developer, and, if there is too little solution, come in contact with the surface of the plate, and there adhere.

Opaque spots are always due to defects in the plates, and cannot be corrected by after manipulation.

A *yellow stain*, or rather a yellow veil, in the shadows of a negative is often found after pyrogallic development, especially if the process has been very prolonged, or if much ammonia have been used. Such stain should never occur if our instructions be carefully followed, but if it do, it may be removed by placing the negative, after fixing and washing, in the following solution :—

Saturated solution of alum	...	10	ounces
Hydrochloric acid	...	...	$\frac{1}{4}$ ounce

Mr. Herbert Berkeley has recently introduced a new developer, which totally prevents any yellow stains from occurring, and which deserves strong recommendation. The pyrogallic stock solution is mixed with four grains of neutral sulphite of soda to each grain of pyrogallic. The whole is rendered slightly acid with citric acid, for it must be understood that so-called "neutral" sulphite of soda is really alkaline. Care must be taken to use the *sulphite*, not the *sulphate*.

Unequal thickness of film is sometimes found in commercial plates. It arises from careless coating of the plates, and is, of course, incurable by after treatment. The negative resulting from a plate more thinly coated at one place than at another may be lacking in density at the thin place ; but it should be borne in mind that it need not certainly be so. Plates are generally coated with films considerably thicker than is absolutely necessary, and, in the case of a plate unequally coated, the thinnest part

may contain enough of the silver salt to give the necessary density. Plates should, therefore, be tried before being condemned for unequal coating.

Various *streaks, scratches, &c.*, occur in gelatine plates, and are evidently due to defect in manufacture. They call for no particular remark.

A *white powdery deposit* is sometimes found on the surface of the negative after drying, especially after ferrous-oxalate development. It is, in such a case, caused by lime in the washing water. It may be removed by dipping the negative in a 1 per cent. solution of hydrochloric acid. If the solution of alum used before fixing be acid, and the negative be not sufficiently washed between the alum and the fixing-bath, a deposit of sulphur will form in a fine powder. This may be removed by gently rubbing the face of the negative with a plug of cotton-wool while water is running on it from the tap.

Irregular action of the developer, causing zig-zag lines across the plate, may occur if the developer has not been made to flow over the plate in one wave at first.

Halation is caused chiefly by reflection from the back of the plate. It makes itself evident only when the subject includes very strong contrasts; for example, when an interior with windows open to the sky is photographed. It shows itself in the form of a halo round the highest lights, and produces a very unpleasant effect, sometimes known as blurring. It occurs only to a small extent with plates that are very thickly coated. In the case of an attempt being made to photograph a very trying subject, such as the interior mentioned, it is well to "back" the plate; that is, to paint or otherwise cover it at the back with some substance which will absorb light. The following is a good method to adopt. Procure a piece of black carbon tissue,

cut out a piece slightly smaller than the size of the plate to be used (there should be about $\frac{1}{8}$ of an inch margin all round) moisten the black surface of the carbon tissue with glycerine, allow all that will to drain off, and press the tissue against the back of the glass. It will adhere, and may be removed just before development.

CHAPTER XI.

VARNISHING THE NEGATIVE—PRINTING:

THE photographer who has followed our instructions to the present point will so far have produced only means to an end ; the end itself will be nowhere visible. He has made the materials for a picture, but the picture has still to be constructed from these materials. However delightful a negative may be to the photographer as containing infinite possibilities, it is to the common eye by no means a thing of beauty. Every shade is, as we explained, reversed ; before a natural effect can be produced these shades must be re-reversed so as to represent those of nature. This is commonly done by resorting to the process of printing. This process consists in the placing in contact with the negative a sensitive film usually supported on paper, and allowing light to act on it through the negative—the effect being, as a little consideration will show, a reversal of all shades.

There are many printing processes, all of which may be studied with advantage by the amateur. Each one has certain advantages, and some are especially suited for certain purposes ; but the process which, on the whole, has

held its own against all others, and which for general purposes seems not likely to be soon superseded, is that known as "silver printing on albumenized paper." We propose to describe this, and to leave our readers to refer to more advanced or more special treatises for instructions in the various other processes.

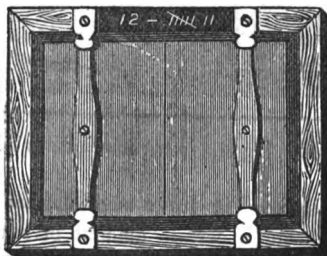
"Ready sensitized" albumenized paper is now an article of commerce, and its convenience is so great that we should recommend its adoption by the beginner, and shall here describe the manipulation of such paper before we give instructions in the sensitizing of paper for immediate use. When the photographer has thoroughly mastered the process of printing, he will probably find that he can gain a higher degree of excellence by sensitizing his own paper; but certainly at first the contrary will be the case.

It is advisable to take a trial print from every negative before the process of varnishing is performed, and, in fact, if ready sensitized paper, which is always quite dry, be used, varnishing is not absolutely necessary. It is very advisable, however, and we shall describe the process before entering on the subject of printing.

After the negative is thoroughly washed and quite dry, take it by that corner which, were it a printed page, would be the left-hand bottom corner. Let it be warmed gently over a gas-burner till it feels just warm enough to be pleasant to the touch. If a gas-burner fixed above the level of the operator's head be used, a good criterion of the proper temperature is gained by watching the moisture which condenses on the plate from the water formed by the gas flame. When the moisture at first condensed is dispersed, and no more will condense on the plate, it is just at the right temperature. Let the plate be now held level by the corner mentioned between the finger and

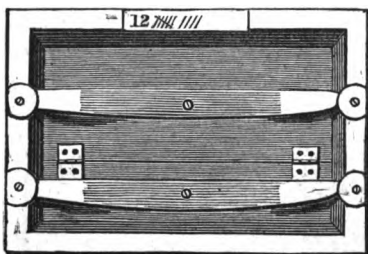
thumb of the left hand, whilst the varnish bottle is held in the right hand. Let a large pool of varnish be gently poured on to the centre of the plate. This pool should cover about half of the area of the plate. Let the plate be gently "tipped" so as to cause the varnish to flow first to one corner and then to another, beginning at that opposite to the one by which it is held. When the varnish comes round to the bottom right-hand corner, let the plate be tipped slowly up to a vertical position, so that all the excess of varnish may flow back into the bottle. The plate must be rocked from side to side during this part of the process to prevent the formation of crapey lines. When all the excess of varnish has flowed off, the plate must be again warmed—this time till it is about as hot as the hand can bear. When it is cold it is ready to be printed from. There is a vast difference between plates as to the ease with which the varnish will flow over them. The process is one which should in no case be performed over a choice carpet.'

In printing with albumenized paper a printing frame is



used. This apparatus is of various forms, but all these forms have the same object. They keep the paper in close contact with the negative, and are so constructed that one

half of the print can be examined at any time, whilst the other is kept in contact with the negative to prevent it from slipping. In frames made at the present day the necessary pressure on the backs is gained by the use of springs. For small negatives, the frame is usually made exactly to fit the plate. In the case of large negatives—above whole-plate, for example—the frame is generally made somewhat larger than the negative for which it is intended, and is fitted with plate glass, against which the negative is placed. The pressure of the springs would be liable to break a large negative were it not thus protected. In the case of large negatives it is also necessary to use a pad of felt between the paper and the back of the frame to ensure contact. We illustrate two of the forms of printing frames. A neat “dodge” is shown at the side of the



frame for registering the number of prints taken from any negative.

We shall suppose that our beginner has purchased a printing frame and a certain amount of ready sensitized paper. Let him cut the paper to about the size of the negative he has determined to print from. Now let him place a piece of the paper under the negative in the frame, and place the whole outside in a bright diffused light. It

is not generally advisable to print in full sunlight. After the operation has gone on for a short time—say five or ten minutes—the result may be ascertained by taking the frame into a weak light and examining the print, one half at a time. It must be made considerably darker than it is finally required to be. The exact amount of depth that is lost in the after processes can only be learned by experience, but we may roughly say that it is necessary to print for about twice as long a time as that required to give a pleasing result in the frame.

When the desired number of proofs have been printed, the paper should be trimmed to the correct size. This is generally done with scissors, using “cutting moulds,” or thick plates of glass, which can be had of any size. Many prefer to trim their prints after they have gone through the various processes of toning, fixing, and washing; but there are several advantages in trimming before toning. The clippings, if kept, become, when a large quantity has accumulated, of value; there is a saving of toning solutions, and the trimming is far easier to do before washing, as the paper lies flat; whereas, afterwards, it curls up in a way which makes it difficult to manipulate.

The following solutions should be prepared for toning :—

Chloride of gold ...	...	...	15 grains
Acetate of soda ...	...	...	1 ounce
Water ...	...	...	15 ounces

The chloride of gold is purchased in small sealed tubes holding fifteen or thirty grains each. One of these tubes is placed in a bottle capable of holding the whole solution; when there, it is broken by striking it with a glass rod, due care being taken not to break the bottle, which is quite

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possible. The acetate of soda is then added, and the water being poured in, the whole is shaken till the acetate dissolves. The solutions must be kept at least twenty-four hours before being used, and must not be exposed to a strong light. It should be labelled, "TONING SOLUTION, ONE GRAIN TO THE OUNCE." The other solution which is required is one of three ounces of hyposulphite of soda to each pint of water, and should be labelled "FIXING SOLUTIONS FOR PRINTS."

It will be noticed that the prints as they come from the frames are of a more or less unpleasant colour. The operation which is to be described, and which is called toning, is intended to correct this defect, and to give them the pleasing colour which we are accustomed to see. The process consists in covering the image with an exceedingly thin film of gold.

Toning may be said to be at once the easiest and the most difficult of photographic processes. Nothing is easier than to *tone*, nothing more difficult than to *tone well*. Anyone can change the colour of a print to a sort of slaty grey; there are not very many who can be sure of getting at all times a pleasing tone and the exact tint required. The difficulty lies in the direction so common in photographic operations. A certain result is gained, but the after processes modify this result, so that great experience is necessary to know beforehand what will be the final appearance of the subject.

We shall describe as exactly as possible the operations, and for the rest, as in so many cases, the beginner must look to intelligence and experience for success.

The toning solution mentioned in the first part of our lesson is too concentrated to use as it is; it must, therefore, be diluted. The common practice is to use a large

quantity of toning solution, and, if it is not exhausted, to keep it for after-use. This is very well for the professional, who tones at regular intervals, but in the case of the amateur we think it is not advisable. The solution once used is very liable to "go bad," the gold being deposited at the bottom of the bottle. We therefore recommend that the beginner estimate the amount of toning that will be necessary, allowing a little margin, and after he has used it once, throw it away. The waste will be very small—so small that it will not be found worth while to keep the liquid as residue. If the prints be trimmed before toning, one grain of gold is amply sufficient for each sheet of paper measuring 17 inches by 22 inches. Let, therefore, one ounce of the stock toning solution be taken for every sheet of paper, and let it be diluted with six or seven times its amount of water.

Now let the prints be taken one by one, and placed in any dish which is suitable for washing them in; a common small wooden tub is the best of all. Let the prints be kept from sticking to each other, and be moved about by hand. It will be seen that the water becomes milky from the nitrate of silver in the paper forming chloride and carbonate of silver with the salts in the washing water. The water must be changed several times till this milkiness disappears entirely, or almost so. Now the prints are ready for toning. The washing is best done by the light of a candle or lamp, as such will not affect the paper. The toning must be done in feeble white light, as it is difficult to judge of colours by yellow light. It is best performed in a flat white dish at least an inch larger each way than the prints.

Let one print be taken from the washing water, and placed in the toning, first face downwards, then turned

face up, then down, once or twice, so as to allow the solution to act evenly on it. Now let another print, and perhaps two or three more, be similarly placed in the solution. It will be noticed that the prints, during washing, turn to a brick red. In the toning they will turn to a brown, and gradually to a sort of violet or purple. They must be kept in constant motion. The best plan is to keep continually lifting the undermost print, and placing it on the top. At first, only a few prints should be attempted; after some practice, a dozen or two may be in the solution at once. When many prints are toned together, it is a good plan to have two dishes of toning, side by side, and keep lifting the prints out of one into the other, the whole of the prints being turned over in a mass when they are all in one dish.

The difficulty is the one indicated before, viz., at the time of toning to discount the change which will take place during the after processes. The difficulty is greatly increased by the fact that every brand of paper acts in a somewhat different manner from any other. Very few ready sensitized papers will stand being pushed to the purple stage; that is to say, if the toning is continued to the purple, the final result will be disappointing, although the prints will look beautiful before fixing. It is usually advisable to remove the prints from the toning solution whilst they are still of a very warm brown in the shadows. It is a good test to watch the half-tones, and when these begin to become purple or violet, to remove the print. The prints, when removed from the toning solution, are placed in another dish of clean water. They must be moved about for a short time after first placing them here, so as to get rid of the greater part of the toning solution which is in the pores of the paper, and which would make the toning pro-

ceed after it was desired to stop it. When all the prints have passed through the toning bath they must be washed in several changes of water, being kept moving for about five minutes during each change. Now comes the fixing ; the prints are removed from the washing water, and are placed in a flat dish. Sufficient fixing solution to quite cover the prints is poured in, and they are kept moving for about twenty minutes ; more than one change of colour will be noticed during this time. The first will be an almost total loss of tone ; afterwards the colour will return to something like its former self. A further change will take place when the prints are dried. After fixing, it is necessary to wash the prints most thoroughly for not less than twenty-four hours. This is best done in running water, but if this cannot be had, then frequent changes will do. The smallest trace of hyposulphite in the prints will cause them to fade.

The prints, after washing, are allowed to dry spontaneously, being placed on any clean surface ; or they may be mounted wet on cardboard. In either case they should be afterwards rolled. A rolling press is an expensive article ; but the amateur can generally find some neighbouring photographer who will roll his prints for a small consideration.

The great convenience of ready-sensitized paper is that it will keep for a very considerable time, either before printing, or between printing and toning. The means of preparing such paper is at present a trade secret, and when the amateur prepares his own paper, he will find that it will turn brown after about twenty-four hours. He must therefore do his sensitizing and fixing all in one day. If he has time to do this, he will probably be rewarded by superior results. We shall therefore describe the process of sensitizing.

"Salted" albumenized paper is purchased—that is to say, paper coated with albumen which is impregnated with soluble chlorides.

A "silver bath" is prepared by dissolving nitrate of silver in distilled water. The strength of the bath varies with the paper used. Every dealer in albumenized paper will state what strength of bath is best to use for the particular brand. One containing sixty grains of nitrate of silver to each ounce of solution will suit most papers. Enough of this must be prepared to cover the bottom of the flat dish to be used in sensitizing to a depth of at least $\frac{1}{4}$ -inch. The dish should be half an inch larger than the paper in each direction. If much paper is to be used, it is best to sensitize in large pieces, and cut it into sizes before printing. Professional photographers usually sensitize a whole sheet at a time.

A room lighted by a lamp or gas is the best to carry on the sensitizing process. Strings should be stretched in convenient position for hanging the paper on to dry. American clips are useful for fixing the paper to the strings.

Let the silver solution be poured into the bath, and let a piece of the paper be taken by opposite corners, and with the albumenized side downwards. Let the paper be so held that it will first touch the surface of the solution in a line between the two corners not held by the hands. We again take the *simile* of a printed sheet. Suppose the paper held by the right-hand upper and left-hand lower corners. Now let the left-hand upper corner touch the surface of the solution, and let the paper be lowered till it touches in a line from the left-hand upper to the right-hand lower corners. Now let the two corners held in the hands be dropped, first one and then the other. This sounds elaborate, but is very simple in practice. If it be carried

out properly, there should be no air-bells under the paper, but it is best to lift it from the solution after about a minute and look, to make sure. If there are any, they can be broken by gently moving about the paper whilst one-half is held out of the solution.

The time of floating varies with different papers and different strengths of baths. It should be ascertained when the paper is purchased. With a 60-grain bath from three to five minutes is usually ample. If the paper curl out of the bath at the edges, it may be caused to lie flat by blowing on it.

After the specified time has elapsed, let the paper be removed from the bath by drawing its surface over one edge so as to drain off most of this silver solution. It is only necessary now to hang it up by one corner to dry. A small fragment of blotting-paper should be caused to touch the lower corner immediately that it is hung up. This will adhere by capillary attraction and collect a drop or two of solution which would otherwise fall on the floor.

If the room be warm, the paper will dry in ten minutes or a quarter of an-hour.

When it is dry, printing, toning, &c., are performed as described for ready-sensitized paper. Good paper sensitized as described may be toned to a far deeper purple than the paper purchased ready sensitized.

The silver solution becomes weaker through use, and is necessary to strengthen it at intervals. Its strength can be ascertained by the use of an "argentometer," which is a cheap form of hydrometer specially graduated for grains of silver per ounce of water.

The solution must be filtered every time it is used.

It is the custom with some operators to "fume" their sensitized paper. They claim that a more brilliant result

is thereby gained, and that toning is more readily performed. This is so, at any rate, in the case of certain brands of paper. The process consists simply in exposing the paper to the fumes of ammonia. With those who print on a large scale, a special box, in which the prints are suspended on netting over liquid ammonia, is generally used, but we have been able to succeed very well with a makeshift apparatus. We shall describe this, and the method which we have found to give very satisfactory results.

After the paper is sensitized and dried it will be found to curl up badly, but may be straightened by drawing it, face downwards, between a pad of blotting-paper and a paper knife with a blunt edge.

Let a box of any kind, measuring a couple of feet or so in length and breadth, and (say) a foot deep, be taken. One of those millboard contrivances used by dressmakers in which to pack the finery worn by the superior sex will do very well. Let a small quantity of the stock solution, consisting of one part of strong ammonia and one part of water, be sprinkled over the bottom of the box, the bottom be then covered with crumpled paper, and the sensitized paper placed on this, and let the lid be put on. After things have remained so for a quarter of an hour, the paper will be fumed.

Fumed paper prints somewhat more quickly than that which is not so treated.

CHAPTER XII.

MANUFACTURE OF GELATINE EMULSION, AND COATING OF PLATES.

WE gave it as our opinion, when commencing these lessons, that the amateur will generally find it best to purchase plates from the manufacturer. He will probably find it both cheaper and more satisfactory to do so than to manufacture them himself, unless he has at his disposal considerable time, and unless he has great patience and a happy temperament, which will enable him to bear frequent disappointment, when, after going through the tedious process of making an emulsion and coating the plates, he finds that the latter are, from some unknown cause, useless.

Nevertheless, we believe that the photographer who makes himself acquainted with the process of the manufacture of dry plates, and knows how to make an emulsion, will have a more thorough mastery of the working of them than those who have never made their own plates. There are some few who, for the love of the work, prefer to make their own emulsion. These are the real enthusiasts to whom we look to further our knowledge of photography, and with such the manufacture of plates pays, if it be only

in the satisfaction they have in relying on themselves alone.

The subject of gelatine emulsions and plates is one on which volumes might, and in fact have been, written, and here of course we can but give the briefest instructions. If the photographer succeed with these, he may with advantage take up the study of the advanced works which have been written on the subject.

We do not propose to give the formula which has given the highest sensitiveness in our hands, but shall give one which has given us plates of fair rapidity, and of the very highest quality.

The principal piece of apparatus necessary for making any number of plates is a drying cupboard or box. This is a box arranged so that the plates may be placed in it in such a position that a current of air passes rapidly over the surface of all of them. There are various designs of boxes, some of which are so arranged that the current of air is heated. This is not desirable if a fairly dry place can be had for the drying-box. The motion of the air is usually ensured by burning a gas jet at the lower end of a small chimney or flue. The defect in almost all drying-boxes that we know, is that the air-passages are too small.

The other apparatus necessary is as follows:—

A large slab of plate glass, marble, or smoothed slate, levelled accurately, so that the plates can be laid on it to set. The larger the slab the better, as more plates can be placed on it at once.

A piece of coarse canvas or "scrim," such as ladies do worsted work on—say two feet square.

Several glass beakers or jam pots for mixing and boiling solutions in. The latter are preferable, as glass is very likely to be broken in the dark-room.

An ordinary hair sieve.

A vessel of such a size and shape that the sieve may stand in it, and that when it—the vessel—is full of water, the upper edge of the sieve will stand (say) half an inch above the surface of the water.

A large glass filtering funnel.

Several hock bottles. These, from their deep red colour, are useful for performing the various manipulations in.

An ordinary saucepan.

A Bunsen ring burner, on which this may stand to boil.

Let the following solutions be prepared, and each mixed in one of the jam pots.

A

Nitrate of silver ...	...	...	100 grains
Distilled water ...	...	...	2 ounces

B

Bromide of potassium ...	...	...	85 grains
Nelson's No. 1 gelatine ...	...	...	20 „
Distilled water ...	...	...	1½ ounces
A one per cent. mixture of hydro-chloric acid and water ...			
	...	...	50 minims

C

Iodide of potassium ...	...	...	8 grains
Distilled water ...	...	...	½ ounce

D

Hard gelatine, such as that sold by the Autotype Company for dry plates ...			
	...	...	120 grains
Water ...	...	...	several ounces

Let B and D stand till the gelatine is thoroughly soaked,

as indicated by its being quite soft. Let all the water be poured off D, and let as much water as possible be squeezed out of the gelatine.

The pots containing A and B must now be placed in hot water till the solutions are at about 120° Fahr., when B is poured into one of the hock bottles.

From this time all operations must be performed in the most feeble ruby light possible.

A little of B is now added to the solution already in the bottle, and the whole shaken. Small additions of B are made so that it is poured in five or six stages into A, the whole being shaken at each addition, and a very thorough agitation being given at the end.

C is added, and the solutions, now forming an emulsion, are again shaken.

The whole is poured into one of the jam pots. This is placed in the saucepan, the lid is placed on the latter, and the water brought as rapidly as possible to the boil. A loose cover of some sort should be placed over the jam pot during this part of the process to prevent condensed water from dropping off the lid of the saucepan into the emulsion. The emulsion is allowed to remain for half-an-hour in the boiling water. If, at the beginning of the process, a drop of the emulsion be placed on a plate of glass, and a gas flame looked at through it, the flame will appear very red. The emulsion is said to be red by transmitted light. At the end of the boiling it will be a more or less near approach to blue in colour.

At the end of the half hour the gelatine D is placed among the emulsion, and the whole stirred to mix it. The can is then put in a cool and dark place to allow the emulsion to set. It will do so in from one to two hours on a moderately cool day, but it may be left for days if it

be desired. This is the best period at which to break the process, which is somewhat lengthy to be performed at one time.

When the emulsion is set quite stiff the jam pot is dipped for a few moments in hot water. If it be inverted the emulsion will now fall out of the vessel in the same manner that a jelly for the table drops from its shape or mould. The sieve must meantime have been placed in its appropriate vessel full of water. The lump of emulsion is placed in the canvas, the whole is placed under water in the sieve, and the canvas twisted up so as to cause the emulsion to pass through it in fine shreds into the water. It must now be washed for half an hour, either by allowing water to run into the sieve, or by frequently changing the water in the vessel.

The object of this washing is to get rid of the soluble nitrates and bromide, whilst the insoluble bromide and iodide of silver—the sensitive salts—remain in the emulsion.

At the end of half an hour the sieve may be removed from the washing vessel, and placed in any convenient position with one side somewhat tipped up, so that all superfluous water may drain off. The draining should go on for at least half an hour. At the end of that time the emulsion is finished, and only requires to be re-melted and filtered. We have found nothing better for this than several folds of cotton such as pocket handkerchiefs are made of.

Three-quarters of an ounce of methylated spirits or alcohol is now added, and the emulsion is ready to be used for coating the plates. The quantity will be about six or seven ounces. It may be kept in one of the hock bottles, wrapped in brown paper. A small earthenware teapot is the

best thing to pour the emulsion on to the plates from. It should be very small; such an one as holds a few ounces, and is used by children at a "doll's tea party," will do. The smallness of this allows a constant check to be put on the quantity of emulsion given to the plates by counting how many are coated by each fill of the teapot.

The glass plates must be thoroughly cleaned before being coated. This may be done by dipping the plates in a 5 per cent. mixture of nitric acid and water, then rubbing them under the tap with a wet cloth, and afterwards drying with a dry cloth. If they have been coated with emulsion before, they should be left at least twenty-four hours in the dilute nitric acid, and then rinsed with hot water. Finally, they should be rubbed with a cloth dipped in methylated spirit. This causes the emulsion to run readily over them.

Let us suppose the plates ready to coat. The dark-room lamp is placed within a few inches of the right-hand end of the levelling-shelf, and at the back of it. To the left of the lamp is the pile of plates; to the right a glass measure or jam pot, or other convenient vessel, in which to stand a glass rod to be ready to hand. The glass rod should be about two inches longer than the breadth of the plates to be coated. Immediately in front of the lamp is placed the teapot full of melted emulsion. A plate is taken from the pile. It is placed as far forward on the levelling-shelf as possible, and in front of the lamp.

A pool of emulsion, about half covering the plate, is poured from the teapot. The glass rod is taken between the fingers and thumb of each hand, and dipped into the pool of emulsion right across the plate. The emulsion will run between the rod and the plate to each edge of the latter. By a motion of the finger and thumb of each

hand the rod is lifted the smallest possible distance from the plate, and is rapidly moved first to one end, then to the other, the tips of the finger and thumb resting on the level table as a guide. This, if properly done, will cover the whole plate with emulsion; and if the plate be small—under whole-plate size—it is sufficient to slide it to the far end of the table to set. If the plate be large, the coating will not be evenly spread unless it is lifted, balanced on the tips of the fingers of the left hand, and gently rocked for a few seconds. By this method plates may, after a little practice, be coated with great rapidity. There is no need to wipe the rod each time it is used.

Each ounce of emulsion must not be made to cover more than six or seven quarter-plates or three half-plates.

The plates will “set” in a few minutes—that is to say, the emulsion will stiffen like a jelly—and will not run off the glass, whatever position it is placed in. They are now transferred to the drying-box. They will take from six to forty-eight hours to dry, according to circumstances. When dry, they are ready for use.

If a very rapid emulsion be desired, the boiling may be continued for from one to two hours, the emulsion, after washing, be rendered neutral or slightly alkaline by the addition of about twenty drops of the ten per cent. mixture of ammonia and water, and be kept for a couple of days before coating the plates. We would strongly advise, however, that the beginner confine himself to a slow emulsion.

CONCLUSION.

IN conclusion we have but little to say. We have endeavoured in our "lessons" to give as clear and as practical instructions in the various manipulations connected with negative making and printing as possible. It must be understood, however, that few rules or instructions appertaining to photography are absolute; they are all varied by circumstances. All that can be done by written instructions is to guide the intelligence of the beginner. When he ceases to be a beginner, he should depend on his own intelligence and faculty of observation more than on any instructions.

Let the student not be discouraged by failure. Failures he is certain to have. Even the most experienced fail occasionally, the majority more often than they are willing to allow; and if they do not always succeed, it is unreasonable for the tyro to expect to do so. Nevertheless, he should aim at perfection, and should not be satisfied till he reach it. Let him remember that at least in landscape work no amateur need despair of reaching the highest degree of perfection. Amateurs and professionals compete continually against each other, and the former as often as not carry off the palm.

The young photographer should, from the first, exercise his faculty of observation, and note the most minute departure from received rules. There are few departments of science in which there is so wide a field for investigation as in that of photography, and even the veriest tyro, if he observe closely, may add his mite to the mass of knowledge, which has been built up, for the most part, of such mites of observation freely given to "the brotherhood" by those who have made them. Frequently, a fact noticed by one comparatively inexperienced in photography may give the hint to a more experienced investigator, who may make good use of it.

Another thing to be impressed on photographers is that they should not fear to give others the benefit of their observations merely because it is possible that similar observations have been made before. It is sufficient that a fact is not generally known or appreciated to justify its publication, and the oftener it is published until it is appreciated, the better.

We have before remarked that, if the beginner can get the help of a photographic friend, he will find his first labours much lightened. We would now urge upon him that, whenever he begins to feel his way, he should, if possible, join one of the numerous photographic societies which there are in the country. Let him not suppose that he will meet with ridicule or contempt on account of his comparative ignorance. The writer was for some time deterred from joining a photographic society for such a reason; but, on attending the first meeting, all his fears were dissipated. The terrible "professional" whom he had dreaded to meet he found to be a most kindly individual, willing—nay, apparently anxious—to give what aid he could to anyone who asked advice or assistance from

him. In this respect we believe photographers are different and superior to most other professional men. An amateur architect, or engineer, or doctor would by no means meet with the same kindly reception from professionals at the gatherings of their societies that the amateur photographer does at the gatherings of societies composed chiefly of professional photographers.

Finally, we repeat our advice, that the reader, while he is still unfamiliar with the various manipulations, follow to the letter our instructions ; but that when he begins to feel his way, he trust to his own intelligence as his great guide. If he do this, we are sure that from the time he first succeeds in producing by development *something* on his plate, till the time when he has arrived at such perfection that he need not hesitate to hang his pictures on the walls at photographic exhibitions side by side with those of the first photographers of the day, he will feel that every step in advance which he makes is a triumph, and will find his work—or play, as he likes to consider it—a more absorbing and delightful one than almost any other that he could have taken up.

Let him bear in mind that every operation is but a means to an end (the end being the picture), and that *any* means that conduces to the end is permissible. Let him remember, whatever may be said to the contrary, that photography is a fine art, or, at least, is capable of being such in the hands of those who have any art feeling in them. It is too common a thing to hear painting compared with photography—of course, to the discredit of the latter. This is not right. The two are, in reality, not comparable ; they are different in intention and in essence. Nevertheless, photography is—silently and slowly, perhaps, yet surely—influencing painting. It

is teaching painters the great lesson that without truth there can be no true art. In this do not let us be misunderstood. We do not mean to say that unless some object be rendered with strict accuracy there is no art; but we mean this, that unless an object—say a tree or a man—is represented as it is *possible* for this object to be, then there is not art. If a man or a horse is represented in a position that no man or horse ever was in, will be in, or could be in, then this is wrong. If a house is shown as it could not stand, or a mountain as no mountain exists, it is wrong. Here painters—let them confess it or not—are being educated by photographers.

We now seldom see portraits of men and women showing proportions between feet, hands, head, and body, such as never were; but we have only to look at portraits of fifty years ago (sometimes by eminent artists) to see that at one time things were different—that almost every man was represented as a monstrosity. In landscape painting the influence of photography is not so great, but it is there, and will continue to make itself more and more felt.

On the other hand, one of the highest phases of art is that which selects and combines, which, without representing a scene exactly as it is, is careful to show it as it *might* be. The power of thus selecting and combining is one of which photography is all but incapable.

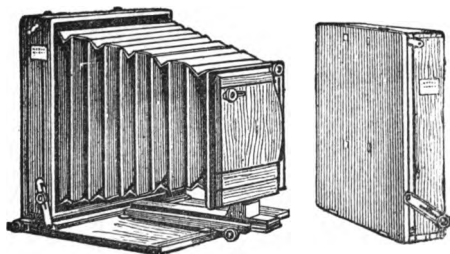
We would fain carry our reader on to more advanced branches of the art-science; we would with pleasure instruct him in the various methods of producing permanent prints, and in the delicate manipulation of vignetting and combination printing from two or more negatives; in the mysteries of enlarging, and in the thousand and one various manners in which the end—a picture—may be produced from the photographic beginning—a negative; but such is without

our limits, and we recommend those who wish to go deeply into the matter to read diligently any of the several excellent and complete manuals or text-books on photography which exist.

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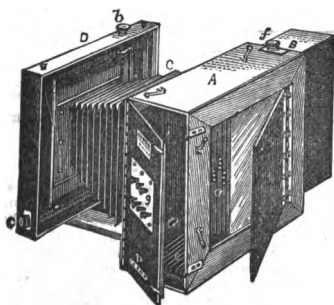
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